consistent with standard clinical practice. However, to facilitate linear interpolation between MC calculated values the simulated field sizes should be increment in steps of 0.05 cm.

PROFFERED PAPERS: RTT 1: GEOMETRIC UNCERTAINTIES: A MULTIFACTORAL PROBLEM?

OC-0069

Dosimetric consequences of total marrow irradiation positioning with volumetric modulated arc therapy

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Purpose/Objective: Total marrow (and lymph nodes) irradiation (TMI and TMLI) by volumetric modulated arc therapy (VMAT) was shown to be feasible. Many arcs with different isocenters are required to best cover the hematopoietic or lymphoid tissues target and to spare the neighbour healthy tissues according with ALARA principle. The direct consequence is the necessity of overlapping regions between *neighbour arcs*. In this study we evaluated the dosimetric consequences of inaccurate isocenter positioning during the treatment of TMI and TMLI treatments using volumetric modulated arc therapy (VMAT).
Materials and Methods: Two *plans* were randomly selected from the internal database of patients treated with TMI or TMLI using VMAT technique (one per case). Dose prescription was 12Gy to target in 6 fractions, 2 times per day for TMI, and 2 Gy in single fraction for TMLI. All body bones were defined as PTV. For TMLI, treatments lymph nodes and spleen were considered too. Ten arcs on 5 isocenters (2 arcs for isocenter) were used to cover the upper part of PTV (i.e. from cranium to middle femurs). For each plan, two series of random shifts (between -3 to +3 and -5 to +5 mm) were applied in each single direction (Left-Right (LR), Anterior-Posterior (AP), Cranial-Caudal (CC)) for each isocenter (total of 60 random shifts) simulating involuntary patient motion during the treatment. The shifted plans were recalculated with the same monitor units and compared to the reference ones in terms of target coverage (mean dose to PTV, $V_{80\%}$ (i.e. %volume receiving at least 80% of the prescription dose), $V_{90\%}$, $V_{95\%}$, $V_{110\%}$, Homogeneity index HI=($D_{2\%}$-$D_{98\%}$)) and body in terms of mean dose and max dose (i.e. D_{10cm3}).
Results: No substantial differences (<0.5%) were found for mean dose and $V_{80\%}$ to PTV, and mean dose to body between the reference plans and the ones randomly shifted in the 3 directions. For all other parameters there was a worsening with random shift increasing. In particular the differences were <1% and <4% in LR and AP in case of, respectively, 3 mm and 5 mm random shifts, but became higher for CC shifts. In detail, $V_{95\%}$ decreased from 95% to 88% in case of TMI and 5 mm shift; $V_{110\%}$ passed from 7.4% to 11.0% and 11.6% for TMI with 3 and 5 mm shifts. Homogeneity index enlarged of 4% and 7% for TMLI case. Maximum dose to body increased of 7% and 19% for TMLI case.
Conclusions: The correct isocenter repositioning of TMI-TMLI patients is fundamental, in particular in CC direction. A dedicated immobilization system was developed in our center to best immobilize the patient.

OC-0070

Comparison of setup accuracy of two immobilization systems for head and neck treatment by daily MVCT in tomotherapy

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Purpose/Objective: The purpose of this study was to compare the setup accuracy of two different immobilization systems for radiotherapy at head and neck region.
Materials and Methods: 36 head and neck patients were recruited in this study, of which is composed by patients using the Orfit immobilization system (n=15) and patients using the CIVCO immobilization system (n=21). A total of 911 sets of Megavoltage Computed Tomography (MVCT) images were obtained. Prior to each daily treatment, a set of MVCT images was acquired and fused with the planning CT images. From the image registration result, the detected setup corrections of three translational deviations (longitudinal, vertical and lateral) and the roll rotational deviations were recorded and analyzed. Systematic errors, random errors, and 3D vectors were calculated and compared between the two immobilization systems. The sizes of the clinical target volume-planning target volume (CTV-PTV) margins were also determined from the calculated systematic errors and random errors.
Results: Calculated systematic errors, random errors, 3D vectors and CTV-PTV margins were demonstrated in Table 1. No significant difference was identified between the calculated systematic errors of Orfit and CIVCO immobilization systems ($p>0.05$). Orfit immobilization system had a significantly smaller random errors in the translation deviations of lateral, longitudinal and vertical directions with the differences of 0.3mm, 0.5mm and 0.1mm respectively ($p<0.05$) . There was no significant difference in roll rotational deviation found between Orfit and CIVCO immobilization systems ($p>0.05$). The 3D vector mean of the Orfit immobilization system was found substantially smaller ($p<0.05$) than which of CIVCO. The calculated CTV-PTV margins showed that Orfit system required 1.2mm and 2.4mm smaller margins in the lateral and longitudinal direction, respectively, when compared with CIVCO.

	Σ lat	Σ lng	Σ vrt	Σ roll	σ lat	σ lng	σ vrt	σ roll	3D vector mean	CTV-PTV margin (lat)	CTV-PTV margin (lng)	CTV-PTV margin (vrt)
	(mm or degree)											
Orfit	1.0	1.2	1.3	1.0	0.8	0.8	0.8	0.9	4.2	3.1	3.7	3.7
CIVCO	1.4	2.1	1.3	0.8	1.1	1.3	0.9	0.8	4.6	4.3	6.1	4.0

Σ= systematic errors, σ= random errors, lat = lateral, lng = longitudinal, vrt = vertical, roll = roll
CTV-PTV margins calculated by using formula of van Herk et al :
CTV-PTV margin M=2.5Σ (Systematic error) + 0.7σ (random error).
Statistical significant results were represented by underlined numbers.
Conclusions: The random errors in translation deviations were found to be less significant in the Orfit immobilization system, which indicates that it gives smaller daily setup variations when compared with CIVCO. The CTV-PTV margins calculated in lateral and longitudinal were also smaller in the Orfit system.

OC-0071

Inter-tester reproducibility of tumour-change in SCLC cancer patients undergoing chemo-radiotherapy

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Purpose/Objective: Small cell lung cancer(SCLC) is a tumour site considerably influenced by tumour changes during delivery of chemo-radiotherapy. In this study we have compared tumour change across three methods.
Materials and Methods: A total of 37 SCLC pts treated with on-line image registration during 2010-2011 were included. The treatment dose was 45Gy in 30.fractions(fr), twice-daily (31pts) or 50Gy in 25.fr, once-daily (6pts). In addition the pts were treated with 4-6 cycles of chemotherapy (carboplatin/cisplatin and etoposide). The gross tumour volume at tumour site(GTV-T) was delineated at a pre-treatment 4D CT scan. The pts were treated according to 3D CBCT bony anatomy registration. Each scans were retrospectively reviewed for every 6th fr. Kappa(k) statistics with a dichotomous registration of tumour-change or not was used for evaluation of the inter-tester agreement between visual/algorithm and visual/doctor assessment. Paired T-test statistics on log-transformed normal distributed data was used for evaluation of GTV at fr 30 by doctor and algorithm. Tumour change was obtained by deformable propagation of the GTV using the B-spline algorithm in SmartAdapt(Varian Medical Systems). The calculations were based on the assumption: a registration of tumour-change was defined as >5ml or 10-15% changes of the tumour, depending of the tumour size, compared to the planning CTscan.